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**SELECTED CHRONIC DISEASE RISK FACTORS IN MISSOURI: TEN YEAR
TRENDS & PREDICTIONS FOR YEAR 2000**

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DRAFT**Abstract**

Background. A study was undertaken to determine the prevalence rates of three chronic disease risk factors among adult Missourians from 1986-1995, to predict rates and to compare them with national and Missouri's goals for the year 2000.

Methods. Using data from Missouri Behavioral Risk Factor Surveillance System Surveys (BRFSS) 1986-1995, prevalence rates of smoking, physical inactivity and obesity were calculated across age, sex, race and educational levels. Linear regression was used to predict rates for year 2000, for the adults of Missouri as a whole and for particular sub-groups.

Results. There was a 0.9% annual decrease in smoking prevalence and a 4.6 % annual increase in obesity over the 10 years, controlling for age and sex. The trend in rates of physical inactivity was non significant. Continuation of these rates will give smoking rates of 23.6%, obesity rates of 35.5% and sedentary rates of 36.3% by the years 2000. Those with less than a high school education had higher rates for each of the risk factors.

Conclusions This rate of decrease in rates of cigarette smoking is not sufficient to enable the year 2000 goal to be reached until year 2040, and the rates of obesity and sedentary lifestyle are increasing. The BRFSS, which has now been implemented in all 50 states and the District of Columbia, is a useful tool for monitoring progress towards health behavior targets.

Key words : chronic disease, risk factors, smoking, exercise, obesity.

DRAFT**Introduction**

Chronic diseases are the major causes of mortality and morbidity in the United States today. Much of this burden of disease can be prevented by modification of lifestyle risk factors in particular smoking, physical inactivity, poor nutrition and obesity.^{1,2} Recognizing this the US Department of Health and Human Services developed a set of health status and risk reduction objectives for the year 2000, providing a framework to reduce preventable death and disability, to enhance the quality of life and to reduce the disparities in the health status of various populations within our society.³ Priority areas listed in this document include improving rates of physical activity and fitness, adequate nutrition, and reducing tobacco exposure. Prevalence rates of chronic disease risk factors can vary widely across states,⁴ for example in 1995 current smokers ranged from 13.2% in Utah, to 27.8% in Kentucky.⁵ Taking into account these different rates many states have used these nationwide objectives to set state specific goals.⁶

Another of the priority area listed in the National Healthy People 2000 objectives was the development of adequate surveillance and data systems to allow collection of comparable data across states and local areas. One means of accomplishing this is utilizing the Behavioral Risk Factor Surveillance System (BRFSS).⁴ The BRFSS is the largest continually conducted telephone health survey in the world. It was developed in 1981 by the Centers for Disease Control and Prevention (CDC), and provides a measure of state specific objectives as well as national health objectives.^{7,8} By collecting socio-demographic information, progress can also be evaluated on specific population such as those with less than a high school education, racial minorities and low income.⁹ The number of participating states had ranged from 26 in 1986, to the whole nation since

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1994. Missouri is one of 25 states and the District of Columbia that has been conducting the BRFSS annually since 1986.

We are now less than four years from the year 2000, and although the Public Health Service has periodically reviewed progress towards the year 2000 objectives^{10,11} this has been done on a national basis with little emphasis on state level progress.

A collaborative study was conducted between Saint Louis University and the Missouri Department of Health. Based on this study we updated the prevalence rates in Missouri for three chronic disease risk factors.¹² This study predicts year 2000 and year 2010 rates, adjusted for socio-demographic factors for the projected population in year 2000 in Missouri, and compares this with year 2000 objectives. In addition it defines the pattern of these chronic disease risk factors across categories of socio-demographic characteristics. It also illustrates the value of collaboration between public health and academic agencies, and the usefulness of the BRFSS in monitoring chronic disease risk factors and assisting states in monitoring their progress towards state specific and national goals.

Methods

We used data from 14,208 respondents to the Missouri BRFSS from 1986 to 1995 to collect information on the prevalence of selected chronic disease risk factors. The BRFSS is multi-stage, cluster sample that uses a random digit dialing technique¹³ to sample from non-institutionalized adult (≥ 18 yrs) Missourians who have telephones. A computer assisted interview is administered by trained interviewers. Interviews are conducted throughout the year, the sample sizes have ranged from 882 in 1986 to 1572

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in 1995, with response rates of approximately 75%, with a range from almost 70% to 78% over the past 10 years. The survey consists of core questions asked by all participating states, standardized modules developed by the CDC and added at the states' discretion, and special questions developed within each state. Some of the core questions are on a rotating schedule being asked alternate years.

Questions on smoking status, and height and weight, from which a body mass index (BMI) score was created, were available from the Missouri Department of Health for each of the past 10 years. Questions on physical activity were available for 1986-1992 and 1994, since the questions on physical activity were placed on an alternate year activity in 1992. Physical activity was coded as no activity for those reporting no leisure time physical activity in the previous month, or irregularly active for those reporting less than three times a week of activity for 20 minutes per occasion. Smoking was classified as current smokers using responses to questions have you ever smoked 100 cigarettes, and do you smoke now? BMI was used to classify individuals as obese or not obese (BMI >27.3 for women and > 27.8 for men classified as obese ¹⁴). Although hypertension and high cholesterol are important risk factors for chronic disease, and questions are included in the BRFSS, these are not reported, due to uncertainty about the reliability of self-report ¹⁵ and the lack of clinical measurements of these risk factors.

In addition demographic information was collected. Age was divided into 18-34 years, 35-64 year and 65 years and older. Race was divided into white and African-American, due to the small number of other racial groups, and education divided into less than or equal to a high school education or greater than a high school education.

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Age and sex specific prevalence rates of the three risk factors, were calculated for each of the 10 years. In addition sex and education specific, and sex and race specific rates were also calculated. Combining all the demographic factors together to get stratum specific rates led to lack of precision in the estimates due to small numbers, so we calculated year and two demographic factor specific rates which gave standard errors less than 20%. Using these estimated prevalences, a least squares linear regression model¹⁶ was used to predict prevalence rates for year 2000 and 2010, adjusting for the demographic variables above. A chi-square test for linear trend was used to determine whether changes in risk factors over time were statistically significant.¹⁷ In addition prevalence odds ratios of the risk factors were estimated using logistic regression,¹⁸ adjusting for age, sex, race and education, and allowing a further comparison across years and between demographic levels.

All analyses used SAS¹⁹ and SUDAAN²⁰ to allow incorporation of sampling design into the calculation of the 95% confidence intervals around estimates of prevalence and odds ratios. Telephone surveys tend to over-sample certain sub-populations such as women and older persons. To provide a better representation of the overall population and to enable the different samples to combined and compared, the samples were weighted to compensate for the unequal sampling probability due to the following factors: the unique number of phones per household, number of unique phone numbers per primary sampling unit, and post-stratification by age, sex and race.

DRAFT**Results**

The demographic composition over the years were similar and corresponded to the 1990 Missouri census. Overall the majority of respondents were white (89%), with less than a college education (55%), female (53%) and aged 18-34 (36%) or 35-64 years (45%). From the analyses we excluded 0.7% of responses for missing demographic factors, 3% who classified themselves as non-black , non-white, due to the small numbers of these other racial groups, 0.2% for missing smoking information, 3.4% for missing height or weight, and 0.2% for missing physical activity values.

Smoking status

Rates of current smoking showed a slight decline, from a high of 29.7% (95% confidence interval (CI) 27.1, 32.2) in 1987, to 24.4% (95% CI =21.8, 26.9) in 1995. The projected rate for year 2000 controlling for age and sex was 23.6%, and for year 2010 the projected rate was 21.2% (figure 1). The linear trend in the 0.9% rate of decline of smoking rates over the past 10 years was of borderline significance ($p=0.9$). Those aged 18-34 years had the highest rates of smoking with odds of being a smoker 3.8 times higher than among those 65 years and over (95% CI = 3.2-4.4), while those 34-65 years had odds 3.5 times higher than the oldest age group (95% CI = 3.0-4.0). Males were more likely to be smokers (odds ratio (OR)= 1.3, 95% CI = 1.2-1.4) as were those with less than a high school education (OR=1.8, 95% CI = 1.6-2.0). Those with less than a high school education had no significant decline in rates of smoking over the years, with a predicted year 2000 rate of 29%, however those with more than a high school education showed a significant decline in smoking rates, with a predicted year 2000 rate

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of 14.3% (figure 2). There was no difference in racial smoking rates controlling for age, sex and education.

Physical Inactivity

The rates of complete lack of leisure time physical activity ranged from a low of 30% (95% CI = 27.2- 32.2%) in 1986 to a maximum of 36%(95 % CI = 33.7%-38.8%) in 1991. Although the rates were rising this was not found to be statistically significant ($p=0.15$). Using the linear regression the predicted year 2000 prevalence rate of no leisure time physical activity was 36.3%, and the predicted year 2010 rate was 40.3% (figure 3).

The predicted year 2000 rates of no activity for those with a less than a high school education were 46.8%, whereas for those with a higher education the predicted rates were 25.4%, although the trend over time was not significant. The rates of physical inactivity were the highest among those aged over 65 years (OR= 2.2 , 95% CI =1.9-2.5). African-Americans were significantly more likely to be inactive (OR=1.5, 95% CI = 1.3-1.8), as were those with a high school education or less (OR=1.9, 95% CI = 1.7-2.1), and females (OR=1.1 ,95% CI = 1.0-1.3).

Including irregular activity with no activity, i.e. less than 20 minutes 3 times per week, the rates were lowest in 1992 at 58.4% (95% CI = 55.9-60.9%) with a maximum of 62.8% in 1994 (95% CI = 60.3-65.3%). There was no significant change in rate over the 10 years, and the predicted year 2000 rate, controlling for age and sex was 60.3%, with a predicted year 2010 rate of 59.3%.

DRAFT**Obesity**

The rates of obesity increased from a minimum of 21.6% (95% CI = 19.0-24.1) in 1986 to a maximum of 33.1% (95% CI = 30.6-35.6) in 1995 . There was a significant increase in the prevalence of obesity over the years ($p < 0.01$), with an annual increase of 4.6%. The predicted year 2000 rate for obesity was 35.5%, and for year 2010 it was 45.3% (figure 4). The rates were highest for those aged 34-65 years old (OR=1.3, 95% CI = 1.2-1.5), African-Americans (OR=1.5, 95% CI = 1.3-1.7), those with less than a high school education (OR=1.3, 95% CI = 1.2-1.4) and males (OR=1.2, 95% CI = 1.1-1.3). The rates for those aged 35-64 years were predicted to be 41.7% in year 2000 and 51.5% by year 2010. The rates for those with less than a high school education were predicted to be 41.7% by year 2000, whereas for those with a higher education the predicted rates were 37.3% . The trend in increase in obesity for African-Americans and whites was similar, although the rate of obesity for African-Americans was higher than those for whites, with predicted rates for year 2000 for African-Americans of 45.9%, compared to 38.5% for whites.

Discussion

The current trends in these three important chronic disease risk factors suggest the year 2000 objectives are a long way from being met in Missouri, for smoking, physical activity and obesity. We will summarize these results in the context of other studies and discuss implications for public health practice.

Although smoking rates have declined over the past 10 years, the rate of decline has been slow, with the year 2000 rates predicted to be 24% controlling for age and

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gender. If the present trends continue the year 2000 goal (14% in Missouri, 15% nationwide) will not be attained until year 2040. The rate of smoking remains higher for males than for females for each of the age groups examined in this study. This differs from most other states which have seen a closing of the gap between male and female smoking rates. Missouri has been reported to be one of only eight states in the nation which has significantly different rates of smoking between males and females,⁵ and has the sixth highest rate of smoking in the nation reported among male residents.

The predicted year 2000 rates of smoking among those with a high school education or less, are 29% from this study. This again is far from the Healthy People 2000 goal for this group of 20% nationwide and 18% in Missouri. Smoking among those with greater than a high school education is the only one of these risk factors on target for the year 2000 goal, with the rates predicted to be less than 15% by the year 2000. The high rate of smoking is particularly concerning among those with only a high school education, since this group is at risk of chronic disease due to high rates of other health risk behaviors.²¹ The goal for African-American men is for rates of smoking of less than 17% in Missouri by the year 2000, and for nationwide rates for African-Americans to be 18%. However, this analysis predicts that the rates among African-Americans males in year 2000 will be 28%. Once adjusting for age, sex and education there was no significant difference in rates by race, and it may be that the higher rates for African-American males predicted by this model are due to their lower levels of educational attainment.²¹

For physical inactivity, the trend although not statistically significant, is towards an increase in levels of inactivity, with a predicted rate of no leisure time physical activity of

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36% by the year 2000. This is moving away from the national year 2000 goal of 15% of sedentary adults, and the goal of 22% in Missouri. The trend in rates of sedentary lifestyle for those over 65 years gave a predicted year 2000 rate of 40%, almost double the national goal of 22% for this special target group. Again those with less education are more likely to be inactive, as are women, older adults and African-Americans. This is consistent with previous findings and those from the Surgeon Generals report on physical activity.^{22,23} The Missouri year 2000 goal is to increase to at least 50% the proportion of adults who engage in regular physical activity three or more times per week, for at least 20 minutes per session. The predicted rate from this study is 40% by the year 2000, the same as the rate in Missouri in 1986. Previous studies have found variations in the rates of physical inactivity among those aged over 64 years across states, with a moderate decline in rates of inactivity between 1987-1992 in only 19 states.²⁴

The prevalence of obesity is significantly increasing over time, with predicted year 2000 rates of 35%. African-American females were a specific group selected as a priority in reducing rates of obesity, however in Missouri, as in the nation as a whole,¹¹ the rates have continued to rise with a predicted year 2000 rate of almost 45%. Agreeing with previous reports²¹ those with less education had higher rates of obesity, as well as inactivity and smoking, even once controlling for race, gender, and age. Obesity is a well recognized risk factor for diabetes, hypertension, cardiovascular disease and certain cancers.²⁵⁻²⁷ It is therefore alarming that the rate of increase in obesity among adults in Missouri is so great, since this will undoubtedly have implications for future morbidity, mortality and health care costs.

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There are several limitations to this study. The BRFSS is a telephone survey and thus is unable to include individuals without access to a telephone; previous studies have indicated differences in the characteristics of persons who reside in households without a telephone, compared to those who have one.²⁸ In addition these surveys rely on self reported data, and although the reliability of information from the BRFSS has been shown to be high,²⁹ it is possible that this may lead to under-reporting of socially undesirable behaviors. African-Americans, and those with less education may be more likely to under-report smoking.³⁰ In addition smoking has been found to be more prevalent in urban areas than in suburban and non-metropolitan areas regardless of sex, education and race,³¹ and area of residence was not included in our study. The questions on physical activity only account for leisure time physical activity, no attempt is made to quantify occupational physical activity or activities of daily living, which may accumulate to meet recent guidelines on physical activity.³² There was slight change in the wording of the questions in the BRFSS on educational attainment in 1993, and on physical activity in 1986. However this did not change the rates from the predicted levels from previous or subsequent years. In addition since physical activity was changed to an alternate year question in 1992, we do not have the rates from 1995. It is possible that there has been a recent change in the rates of physical inactivity, with increased public awareness following the media attention surrounding the CDC and American College of Sports Medicine recommendations.³²

Public health measures are being taken in Missouri and nationwide to help reduce the rates of these risk factors, with increased state laws on tobacco control,³³ the Surgeon General's Report on physical activity,²² and the Five a Day for Health

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Campaign.³⁴ However, unless there is a marked change in the recent trends, none of the goal set for the year 2000 for these three risk factors will be attained. Further efforts are required particularly among those with less education. In view of the marked increase in rates of obesity among adults, and the high rates predicted for the beginning of the next century, attention must be focused on methods of preventing excessive weight gain. As has been suggested previously²⁷ it may be necessary to implement a statewide, if not a nationwide obesity education program.

The BRFSS is a useful tool for monitoring progress towards the year 2000 goals and also for identifying sub-populations with particularly high rates of chronic disease risk factors. Since the BRFSS has been conducted annually for several years in most states, data can be used to predict future rates of risk factors for states as well as specific sub-populations within them. Collaboration between public health agencies and academic institutions is useful to enable timely analyses of data collected by health departments, and to produce joint plans for action. This information can then be used to increase public awareness and to strengthen public health arguments for increased individual and population based interventions.

References

1. McGinnis JM, Foege WH. Actual causes of death in the United States. JAMA 1993;270:2207-2212.
2. US Public Health Service. Healthy People: the Surgeon General's Report on Health Promotion and Disease Prevention. Washington DC, US Govt Printing Office, DHHS Publication No. 79-55071, 1979.

DRAFT

3. US Department of Health and Human Services. Healthy people 2000: National health promotion and disease prevention objectives. Washington: Public Health Services. 1991.
4. Frazier EL, Okoro CA, Smith C, McQueen DV. State- and sex-specific prevalence of selected characteristics-- Behavioral Risk Factor Surveillance System, 1992 and 1993. MMWR CDC Surveillance Summaries 1996; 45(6);1-36.
5. Centers for Disease Control: State-Specific Prevalence of Cigarette smoking- United States, 1995. MMWR 1996;45(44):962-966.
6. Missouri Department of Health . Healthy Missourians 2000: Public Health agenda for the '90s. Volumes I and II. Jefferson City. 1992.
7. Remington PL, Smith MY, Williamson DF, Anda RF, Gentry EM, Hogelin GC. Design, characteristics, and usefulness of state-based behavioral risk factor surveillance: 1981-87. Public Health Rep 1988;103:366-375.
8. Gentry EM, Kalsbeek WD, Hogelin GC, Jones JT, Gaines KL, Forman MR, Marks JS, Towbridge FL. The behavioral risk factor surveys: II. Design, methods, and estimates from combined state data. Am J Prev Med 1985;1:9-14.
9. Centers of Disease Control and Prevention. Health Risks in America: gaining insight from the Behavioral Risk Factor Surveillance System. Atlanta, GA, 1994.
10. National Health statistics. Healthy People 2000 Review, 1992. Hyattsville, Maryland: Public Health Service. 1993.
11. National Health statistics. Healthy People 2000 Review, 1994. Hyattsville, Maryland: Public Health Service. 1995.

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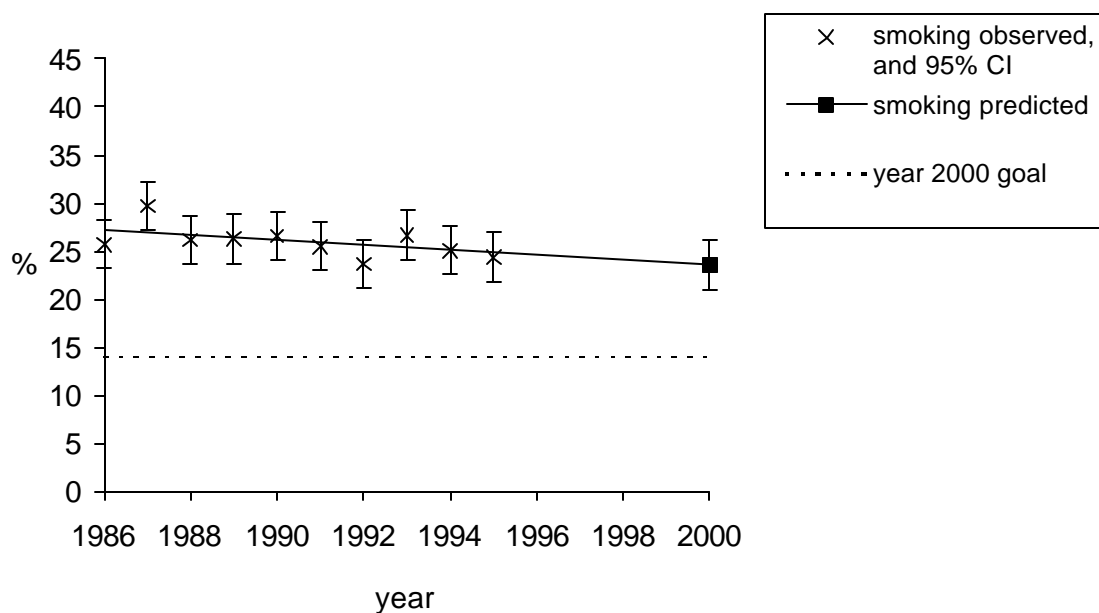
12. Brownson RC, Wilkerson JC, Jackson-Thompson J, Davis JR, Sharp DJ, Northup KM. Trends and projections in selected chronic disease risk factors in Missouri, 1986-2000. *Missouri Medicine*. 1993;90:17-20.
13. Waksberg J. Sampling methods for random digit dialing. *J Am Stat Assoc* 1978;73:40-46.
14. National Center for Health Statistics, Najjar M, Rowland M. Anthropometric reference data and prevalence of overweight, United States, 1976-80. *Vital Health Stat* [11]. 1987;238. DHHS publication PHS 87-1688.
15. Bowlin SJ, Morrill BD, Nafziger AN, Jenkins PL, Lewis C, Pearson TA. Validity of cardiovascular disease risk factors assessed by telephone survey: the Behavioral Risk Factor Survey. *J of Clinical Epidemiology* 1993;46:561-571.
16. Statistical Analysis System Institute Incorporated. *SAS User's guide: Statistics*, Version 5 Edition. Cary, NC, SAS Institute Inc, 1985.
17. Mantel N. Chi-square tests with one degree of freedom, extensions of the Mantel-Haenszel procedure. *Am Stat Assoc J* 1963; 58:690-700.
18. Kleinbaum DG, Kupper LL, Mogenstern H. *Epidemiologic research: principles and quantitative methods*. Belmont, CA: Lifetime Learning Publications, 1982.
19. Statistical Analysis System Institute Incorporated. *SAS User's guide: Basics*, Version 5 Edition. Cary, NC, SAS Institute Inc, 1985.
20. SUDAAN -Software for the statistical analysis of correlated data. Version 6.40. Research Triangle Institute, Research Triangle Park, NC.

DRAFT

21. Centers for Disease Control. Prevalence of selected risk factors for chronic disease by education level in racial/ethnic populations - United States, 1991-1992. *MMWR* 1994;43(48):894-899.
22. US Department of Health and Human Services. Physical Activity and Health; a report of the Surgeon General. Atlanta, GA. 1996.
23. Simoes EJ, Byers T, Coates RJ, Serdula MK, Mokdad AH, Heath GW. The association between leisure-time physical activity and dietary fat in American adults. *Am J Public Health* 1995;85:240-4.
24. Centers for Disease Control and Prevention. State-specific changes in physical inactivity among persons aged ≥ 65 years – United States, 1987-1992. *MMWR* 1995;44(36):663,672-673.
25. Pi-Sunyer FX. Medical hazards of obesity. *Ann Intern Med* 1993;119(7 pt 2):655-660
26. Van Itallie TB. Health implications of overweight and obesity in the United States. *Ann Intern Med* 1985;103(6 pt2):983-988
27. Dwyer J. Policy and healthy weight. *Am J Clin Nutrition* 1996; 63 (35):4155-4183
28. Thornberry OT, Massey JT. Trends in United States telephone coverage across time and subgroups. In: Groves RM, Biemer PP, Lyberg LE, Massey JT, Nicholls WL, Waksberg J, eds. Telephone survey methodology. New York: John Wiley and Sons, 1989.
29. Brownson RC, Jackson-Thompson J, Wilkerson JC, Kiani F. Reliability of information on chronic disease risk factors collected in the Missouri Behavioral Risk Factor Surveillance System. *Epidemiology* 1994;5:545-549.

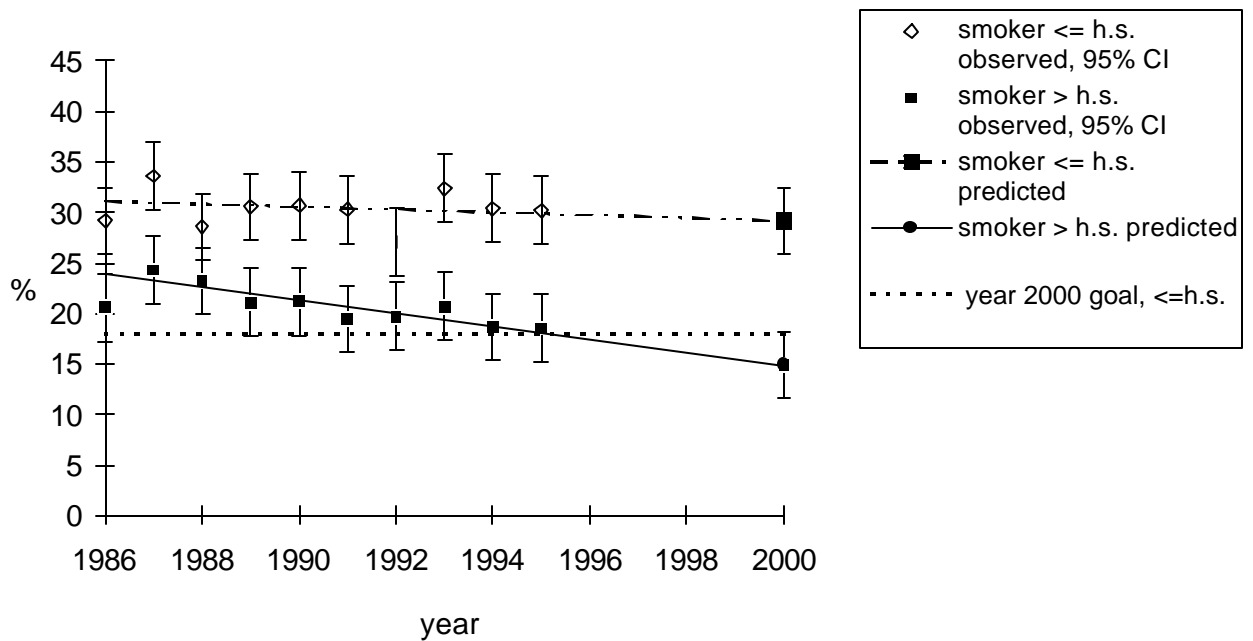
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30. Wagenknecht LE, Burke GL, Perkins LL et al: Misclassification of smoking status in the CARDIA study: a comparison of self-report with serum cotinine levels. *Am J Public Health* 1992;82:33-36.
31. Centers for Disease Control and Prevention. Prevalence of smoking by area of residence – Missouri, 1989-1991. *MMWR* 1995;44(26):4494-497.
32. Pate RR, Pratt M, Blair SN, Haskell WL, Macera CA, Bouchard C, et al. Physical activity and Public Health. *JAMA* 1995;273(5):402-407
33. Shelton DM, Alciati MH, Chang MM et al. State laws on tobacco control - United States, 1995. In: *CDC Surveillance summaries*. *MMWR* 1995; 44(no. SS-6)
34. 5 a day for better health, Md: National Cancer Institute, 1992. RFA No CA-92-17.

DRAFT

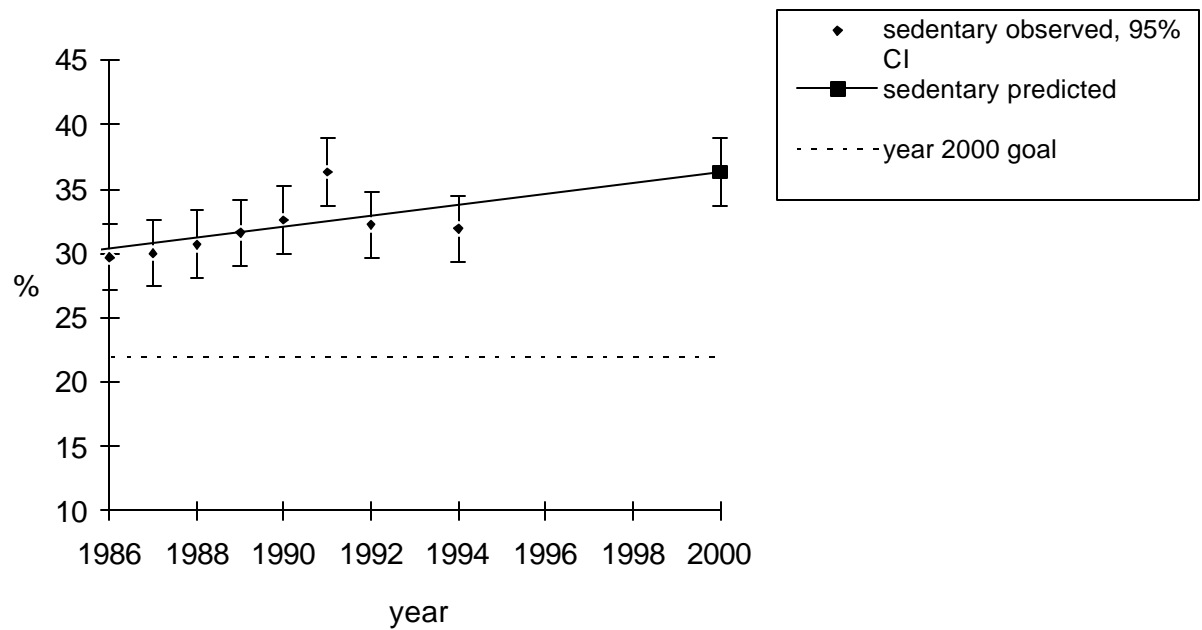
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Figure 1. Current smoking, by year * (BRFSS 1986-1995) and predicted year 2000 rates

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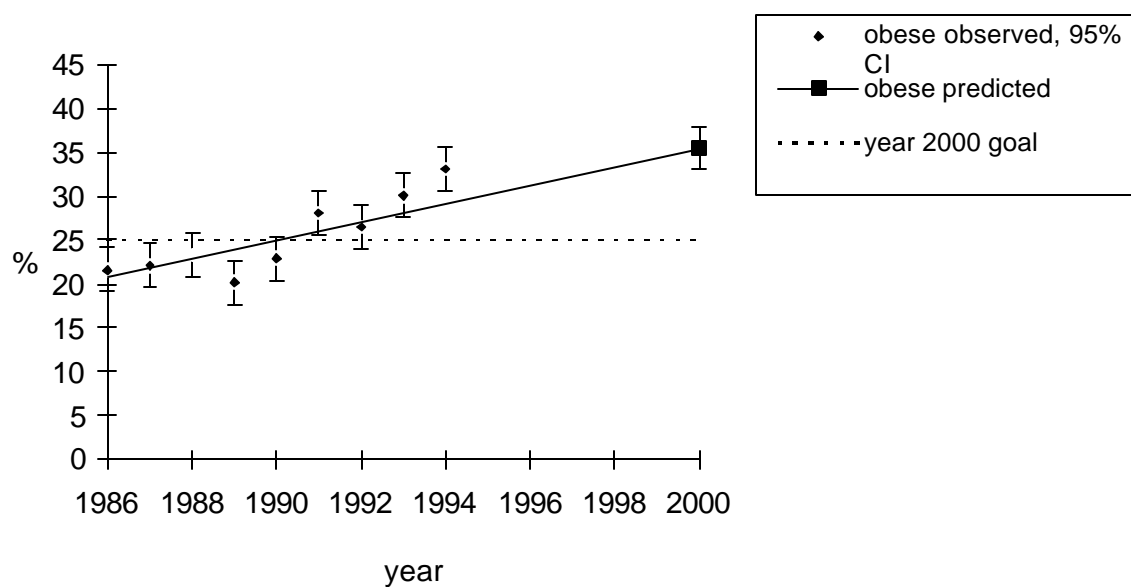
* Adjusted for sex

Figure 2. Education specific smoking rates, by year * (BRFSS 1987-1995) and predicted year 2000 rates

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* Adjusted for age and sex

Figure 3. Sedentary lifestyle rates, by year * (BRFSS 1986-1994) and predicted year 2000 rates

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* Adjusted for age and sex

Figure 4. Obesity rates, by year * (BRFSS 1986-1995) and predicted year 2000 rates